MINES OF PRECIOUS METALS.

MINES of precious metals in the Old World occur chiefly in elevated districts, and nearly always on the sides of high mountains. It may be said, indeed, that these depositories of wealth are always in mountains difficult of access, or surrounded by repulsive, barren scenery. In such places lie the natural minerals, in conformity to a theory almost universally admitted, that, where there are rocks of volcanic origin and upheavals of mountain-chains, there will be found gold, silver, and gems. Nature seems resolved to make man pay the price of her favors, by generally directing the course of the veins toward rugged and desert places.

Chinese Washing Sands with the Cradle at the Australian Placers.

In the New World the South American States are particularly rich in gold and silver. Chili, Bolivia, and, lastly, Peru, the cherished land of the Incas, where, in the latitude of Lima, the City of Kings, and the ancient capital of the "Children of the Sun," stands Cerro de Pasco, the country of silver-mines, on the elevated table-land of the Andes, at a height of above 14,000 feet above the level of the sea.

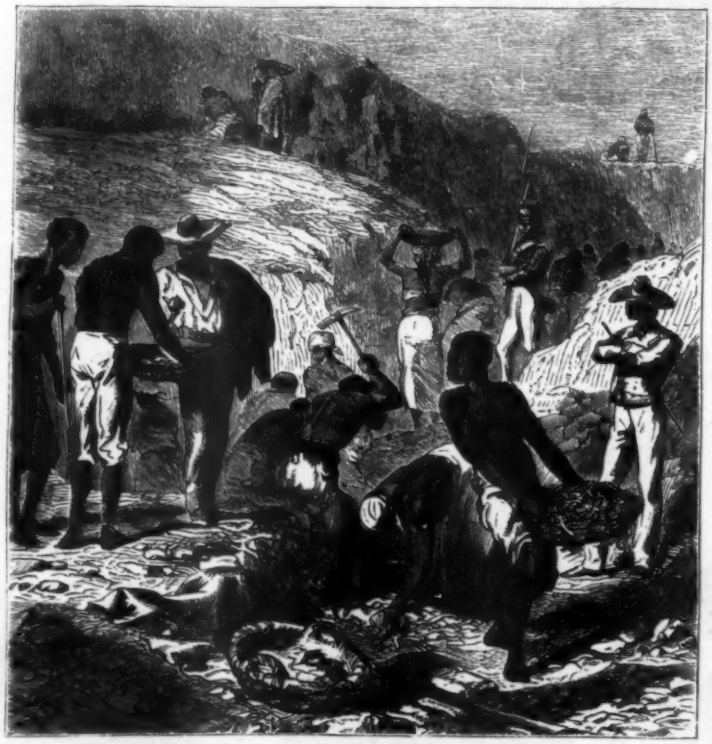
Mexico, however, was the richest land, when discovered by the Europeans, in the precious metals, and, even now, in spite of her constant revolutions, produces the greatest comparative amount of the precious metals. At Guanuxuato is the "Mother Vein," and at Zacatecas is the "Great Vein," two of the largest metallic veins in the world. They are like immense walls of quartz, twenty-two to sixty feet thick on the surface, and one hundred and twenty to two hundred and forty feet deep. It was these gold and other mines

Apache Prisoners condemned to the Mines of Chihuahua, Mexico.

and the rich soil, that caused Cortez to bestow upon the country the honored name of New Spain. The Peruvians and Aztecs were civilized races, practising many branches of industry, that of working in the precious metals being one of them. They heated their furnaces by natural currents of air. They kindled fires on the summit of the Andes, and the magic spectacle presented by these furnaces when at work by night struck the conquerors with astonishment the first time they witnessed it.

From Mexico we come to the province of Chihuahua, so rich in silver, and at last reach California, Oregon, and the Territory of Washington, countries which form one vast domain of gold-diggings, and are the chosen regions of the miner. The early Spaniards gave the name of *El Dorado* to this favored land, as if they foresaw its future grandeur. The county of Nevada, in California, may be reckoned the richest in metalliferous deposits ever encountered in the history of mining enterprise, equalling in production the most famous mines of Mexico and Peru.

Almost simultaneous with the discovery of gold in California was the announcement of similar deposits in Australia, which mines seem to be as inexhaustible as their elders in the "Golden State." We have given a glance at the principal deposits of the precious metals throughout the world; but we find every part of the earth is more or less enriched. Not a single country is left unendowed, and it is probable, as industrious and enterprising as men are, that not half of the mineral wealth of the globe is known. There is, evidently, a law governing the distribution of these hidden treasures. As it regards coal, it appears to have been produced designedly in temperate climates, where civilization sheltered itself at the time of the discovery of the coal-mines. With the precious metals a contrary law seems to exist, the accumulation of these being largest in tropical countries. The exception is certainly displayed in California, where we have the wealth of the tropics and the advantages of a temperate climate.



Working Diamond-Washings.

The miners in precious metals and gems differ very materially from the miners in coal. Among the latter class mentioned a sort of family likeness prevails, and the same discipline distinguishes the work. In the metal-mines, on the contrary, the deposits are dissimilar, and each of them has a mode of its own in working, and the discipline is necessarily varied, and, as a rule, less severe. Lastly, while the ordinary way of mining for coal is scarcely a hundred years old, some of the mines of metal and gems have been worked for ages as they are now worked, and in each of them, in the course of time, have been established peculiar and dissimilar customs.

Throughout the whole of Germany, Saxony, Bohemia, Hungary, and the Tyrol, the miners are remarkable for a sort of unyielding attachment to primitive customs. The German workman occupies a place of his own, having retained unto this day not only the manners and dress, but also the simple superstitions of his forefathers. He believes in gnomes, genii of the mines, in good-natured and malevolent deities. There are good spirits, who produce the ore as fast as it is removed; there are evil ones, who blow out the miners' lamps, and, when greatly displeased, throw them down ladders, or crush them under huge rocks. In working the German mines there have been introduced not only a most practical division of labor, but also a military discipline, and on gala-days the miners appear, dressed in all the gaudy show of genuine soldiers, the officers covered with medals and decorations, the men with colors flying and music at their head, the captain-in-chief in full dress, and bearing before him his baton of office.

In England, as all industrial enterprises are sustained by private enterprise, the engineers of the Cornwall mines bear military titles, but in no instance do they wear the trappings of military office. These Cornish miners, acknowledged to be the best in the world, are superstitious, and tenaciously adhere to old opinions and traditions. The Italian Alps furnish types of miners which, without approaching those we have already mentioned, have curious traits. They are cold, reserved, and true to their word; are steady workers, and were, until recently, great travellers.

The miners of Spain change their character a great deal with the locality and natural scenery of their locality. The Asturian is hardy, somewhat grave, but not familiar or a talker, as are his brethren in the north. The miner of Almaden, alone, poisoned with the vapors of mercury, feels its slow and fatal effects, and goes sadly to death, the victim of underground labor. The work, indeed, in quicksilver-mines is so fatal that, up to the beginning of the present century, only criminals were employed in them in Spain. Now they are attracted by numerous immunities, including grants of land or exemption from military service. They only work on alternate days, and receive medicine and medical advice gratuitously. The Spanish miners live on coarse fare, and occupy buildings which scarcely deserve the name of huts, yet they are a careful, orderly, intelligent race, all of whom, whether miners, muleteers, or founders, doing their duty quietly and thoroughly, obeying their chiefs with complacent and ready willingness.

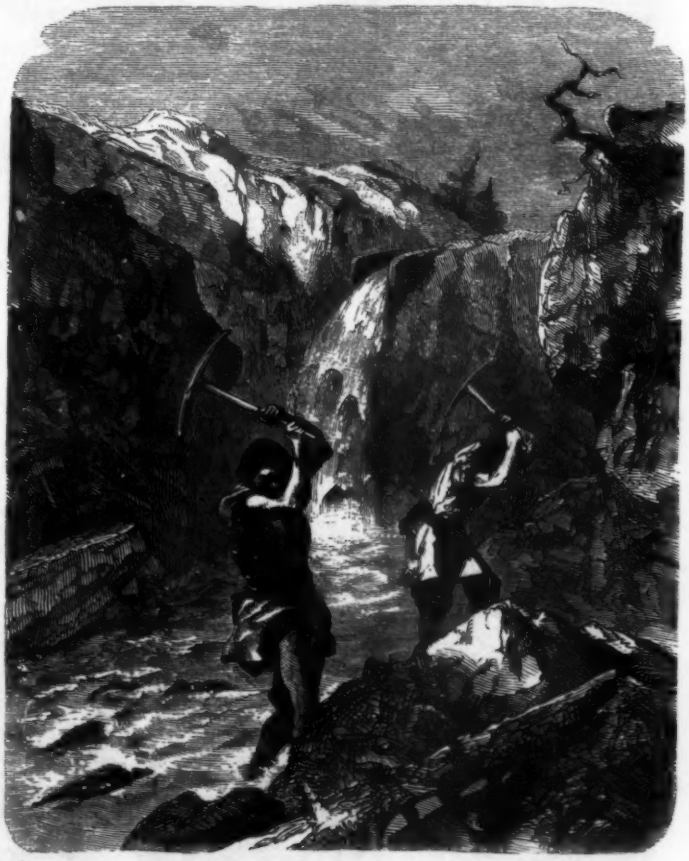
The miners of Spanish America have preserved somewhat of the character of their Andalusian and Castilian ancestors, retaining their sobriety, pride, and constitutional indolence. It has been found that the Spanish-Americans do little work compared with the Anglo-Saxons who have been employed in the South American mines. What a striking difference in the races! The Cornishmen have not their equal in blasting a vein of quartz, and earn by their work ten or fifteen shillings a day; while the work of the Peruvian, Chilian, or Mexican miners scarcely exceeds eight shillings. The Cornishmen are hardy, robust, and great consumers of roast beef, gin, and whiskey; also in their cups fond of quarrelling and fighting. The representatives of the Spanish race, on the contrary, are always calm, temperate, and impassive, subsist on little food, and only work enough to obtain their meagre fare. They also love every thing that produces an effect. They wear a pistol in their belt, a knife stuck in their boot, affect a bright-colored mantle, have rows of silver buttons on their jackets and

down the outside seams of their breeches, and a broad-brimmed hat, covered with lace, and ornaments everywhere.

The American Indians formerly worked in the metal-mines of Spain, and they were treated with a cruelty and avarice that have no precedent even among the ancients who condemned their prisoners to hard labor. This injustice was practised until the colonies obtained their independence of Spain. If the Indians are now met under ground, it is of their own free will, or because they are condemned as criminals to hard labor.

There is no necessity, if it were possible, to draw the portrait of the American miner, representing the citizens of the United States who flocked to California. They were composed of such a heterogeneous mass of educated and enterprising people that their habits and conduct as miners make no impression as a class. But California presents, among others of its wonderful peculiarities, the bringing together, side by side, of the miners of all parts of the world, and thus is given a chance for a comparison of their habits and national peculiarities.

It is not only the Chinese, but also the Spanish-Americans (especially the Mexicans and Chilians), Italians, Germans, and French, who are attracted to the placers. The Mexican and Chilian are fond of gambling and the cigarette, are sober and taciturn. The Italians gradually become traders and fishermen. The Germans are united by the ties of fatherland and music. The French are active and restless, running from one place to another, always grumbling, forever looking back to that belle France which they would live to see again, and to which they hope to return at last.



Chilians Working at the Placers, after the Method of their Country.

Coal-mines are generally discovered by boring in the earth; but this process affords no indication of precious metals. To what, then, is the discovery of these mines due, when strongly marked, significant outcrops, extending to the surface of the soil, long failed to awaken attention? To chance partly, and partly to science. Science, yet in its infancy, has at present made comparatively few discoveries. Chance has generally brought to view the metallic veins, and it thus often happens that those find who do not seek. A shepherd, a poor laborer, and sometimes even children, of which examples will be given, are chosen by Nature to reveal to the world the treasures she has hidden beneath the earth. It was not Columbus, nor Cortez, nor Pizarro, who discovered the greater part of the American mines, but an Indian hunter; and the most famous silver-mines in Peru were discovered in the same way. One day a shepherd, leading his flock to feed on the slopes of the Andes, lighted some brambles to prepare his frugal repast, when a pebble, heated by the flame, attracted his notice by shining like silver. He found the stone massive and heavy, and finally carried it to the mint at Lima, where it was tested, and proved to be silver. As the Spanish laws in America, to encourage the discovery of mines, make them the property of the discoverer, the shepherd worked his mine, and soon became a millionnaire. This story is no mere invention, but a fact which led to the discovery of the mines of Cerro de Pasco, in 1630, in the manner related.

Almost all mining districts would furnish similar incidents. The rich gold-fields of the Sacramento valley in California, for instance, were found by a Mormon laborer, named Marshall, who was at the time employed as a laborer on a saw-mill dam being erected for Captain Sutter. It was on the 19th of January, 1848, that this man, while at work, found pieces of yellow metal, which he, and a half-dozen men working with him, supposed to be gold. Marshall gathered the bits, but the men associated with him finally came to the conclusion that their companion was crazy. In the middle of February a man in San Francisco, who had worked in gold-mines, examined the ground about the saw-mill, and pronounced it richer in the precious metals than any he had met with in Georgia. The discovery created the utmost consternation. Towns and farms were deserted, and left in the care of the women and children. Soldiers and sailors deserted their ships and barracks, and went to the mines; but none were contented, but pressed on to new locations in search of gold. As population increased in California, so did the production of gold, and the whole history of the rise and progress of the Western empire that has so suddenly grown up on the Pacific seems more the recital of the creation of some imaginative brain than of the solid acquirement of material wealth and human happiness. Wonderful, indeed, was the touch of gold.

It is impossible to give, in our limited space, any very detailed descriptions of the various processes by which the precious metals are separated from their natural beds in the earth. The pickaxe and the shovel for all time have been the most common mechanical appliances; but the energy of the California miners introduced new agencies, and to the introduction of powder was added the absolute breaking up of vast tracts of land, by the turning of water-courses, that their beds might be reached, and the materials of even hills and banks were thus minutely washed for this ore.

The precious metal is found in two kinds of natural depositories—earth and rock. In separating gold from the earth, washing, in one process or another, is the great medium, and, to accomplish this object, a great variety of mechanical appliances are brought into use. The Chilian process at first was regarded with the greatest favor, by which auriferous dirt is washed in placers by means of a stream of water; but it is not now considered as practical as the California method. The Californian miners have what they call the Tom, or *Long Tom*, a sort of large and fixed cradle or trough, about twelve feet long and eight inches deep. A stream of water runs constantly through the Tom, in the head of which the *pay-dirt* is thrown by several men,

and, lastly, channels of large dimensions, or lofty aqueducts, constructed on trestles, and called flumes, are all made on the same principle, and intended to effect the same object as the cradle, only on a larger scale.

The ores found in quartz are treated in a different way. In the first place, this hardest of rock must be pulverized before the gold or silver can be extracted. This was formerly effected in the Spanish colonies by rude machines, worked by the natives; but with the discovery of gold in California and Australia came magnificent improvements, under the names of crushers, rollers, and stamps, which pulverize all ores indiscriminately. This mineral dust is not washed, but placed in contact with mercury (quicksilver), which possesses the singular property of acting as a solvent to certain metals, as gold and silver, just as water dissolves sugar; the combination created is called amalgam.

The amalgam which is thus obtained is generally liquid, and, to solidify it, it is squeezed through chamois leather, folded into a bag, and wrung between the hands, like wet linen from which it is sought to express water. The quicksilver separates from the gold, and passes through the pores of the skin, in silvery drops, leaving behind amalgam, of a thick, pasty consistency. We have already stated that quicksilver dissolves gold, just as water dissolves sugar; but heat will volatilize quicksilver. Heat is, therefore, employed, and the quicksilver that has not escaped through the chamois skin is evaporated. In this process the quicksilver ascends from the retort in a vapor, and, by an ingenious process, is condensed in a vessel filled with water. When the operation is concluded, the quicksilver is found in one vessel, and the gold is in the bottom of the retort. It is spongy and porous, and of a pale-yellow color. It is, therefore, thoroughly melted, in black-lead crucibles, and, when thoroughly fused, is poured into cast-iron moulds, which form what is known to commerce as bars, or ingots, in which form it finally reaches the assayers of mints, who weigh it and stamp it into coin, so familiar for business purposes throughout the civilized world.

California Gold-Finder Prospecting the Ground.

Boring a Blast-hole by three Men.

The two chief gem-producing parts of the world are South America and Asia. In India there is a stream the Greeks call "Adamas," or the Diamond. Who does not know of Golconda and the Island of Ceylon? Borneo and China, where rubies and sapphires are obtained, and the whole of Central Asia and the East, are parts of the world most abounding in gems. When a lapidary wishes to express a stone without a rival he styles it *Oriental, Indian, or Syrian*. It is, in fact, in the Asiatic localities that the most beautiful types are found, and up to the present time it is only tropical America that has, to any extent, divided this monopoly of fame with Asia.

Emeralds have been found from the remotest times in Upper Egypt and Abyssinia. The finest pearls come from the Red Sea, the Persian Gulf, and the Indian Ocean. In America, Mexico is celebrated for its opals, and California has its share of precious gems. In the Bay of Panama are pearl-fisheries rivalling those of the Red Sea. New Granada and Peru are distinguished for emeralds. But no country can compare with Brazil, which is the land *par excellence* of the topaz, amethyst, rock-crystal, and diamond. In these respects Brazil vies with India; but this rich-

ness in gems is of comparatively recent date, the diamond having been first discovered in South America less than a century and a half ago.

Of the miners who systematically search for precious stones, the only ones who form as it were a disciplined body are those who work in the diamond-mines. The alluvia which contain the gems are washed in the same way as the auriferous gravels, both having been produced by the same natural causes, that is, by the disintegration of the rocks in which the precious substances were originally contained. The gold-finder washes his dirt, and the gem-bearing sands of Brazil are also washed in a bowl or in a running stream of water. This is done by slave-labor, carried on under the eyes of vigilant overseers. The pick and the shovel are used for breaking up the diamond-bearing gravels almost in the same way as they are employed by the Chilians in working for gold. The water carries away the clay, fine dirt, and sand, and the larger lumps are thrown aside by hand, the middling-sized gravel that remains being picked over in the open air, where the sunshine playing upon the gem readily leads to its detection. The searchers have a particular knack of doing this, and it is wonderful to see how they perceive the smallest particles of diamond among the largest heaps of common pebble-stones. When the gem is found it is placed in a little bamboo case, ornamented, more or less, on the outside, and regarded with a superstitious feeling. It is supposed that a case that has already held diamonds will lead to finding more, and, owing to this belief, the negroes are unwilling to part with these little tubes of reed, particularly if, having been long in use, they thereby assure the owner good luck.

Common Room of Spanish Miners of the Alpujarras (Province of Granada).

The miners take no interest in geological speculations, and only attend to their own operations. When discoveries of any importance are made, they are announced, and when a slave finds a diamond of a certain weight he is immediately set at liberty. At the end of the day

Auriferous Placers of the Tipuani Valley in Bolivia.—After a Drawing in Water-colors by Daherrvoon.

Saxon Mining-Captain in Full Dress, with his Baton of Office.

the work-people have to undergo a most rigid examination, in spite of which thefts are of frequent occurrence.

When the great diamond-washing companies have collected a sufficient quantity of diamonds, they are dispatched to Rio Janeiro, accompanied by an escort of soldiers. There are no railways, and the Brazilian robbers are inventive and ingenious in their operations, yet they seldom commit depredations on a diamond convoy. The search for gems is carried on in Europe, Asia, and elsewhere, in the same systematic manner that it is in Brazil.

The diamond is sold by weight, by the carat, a word which comes from the Hindoo *kuara*, the name of a bean formerly used in weighing diamonds, a conventional weight, indeed, equal to 3¼ grains Troy, and subdivided into a half, quarter, or grain, and eighth, and so on. The price of polished diamonds is $60 per carat for brilliants, the same weight of gold being five hundred times less, or 12 cents. The diamond cut in rose fashion is worth two-thirds of a brilliant of the same weight, and it is calculated in both cases that cutting doubles the price of the rough stone.

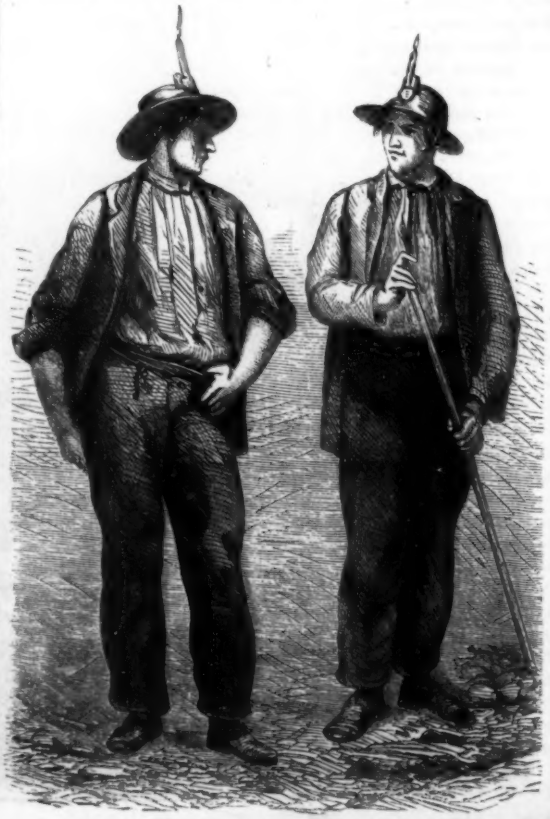
Gold, the most precious and most beautiful of metals, is familiar to all, rich and poor; but the diamond, the most valuable of all gems, is less practically known. Its characteristics and origin are, therefore, of especial interest. It is probably true that diamonds, as well as most precious gems, are produced from aqueous solutions and hot vapors. Time, repose, and the means being favorable, these true tears of Nature are the result; the gem slowly crystallizing out from the surrounding rock from which it originates. Volcanic lavas have given birth to some gems, but always less beautiful in brilliancy than those more naturally born of the water, heat, and lapsing time.

The diamond was called by the Greeks adamant, signifying unconquerable—a name which it deserves in every respect. It is infusible only at the highest temperatures; is insoluble in all acids, and, lastly, it is the hardest of all substances, and can only be acted on by its own dust—which fact gives rise to the popular saying, "Diamond cut diamond." By this process of cutting, the gem has given to it innumerable "faces," which enables it to bend the rays of light, that pass through it, in all directions, giving rise to those radiant reflections in which all the colors of the prism, especially the primary colors, blue, red, and yellow, are thrown off in dazzling rays.

The peculiar lustre of the diamond is known as *adamantine*. If perfect, it is colorless and transparent, pure and limpid, and has the water that indicates the finest possible crystal. The value of the diamond is greatly affected by the manner of its cutting. The pyramidal form, or *brilliant*, stands first in order; the *rose*, flat on the under surface, is the next in estimation; and the *table* diamond, with broad, flat upper and under surfaces, is the least valuable.

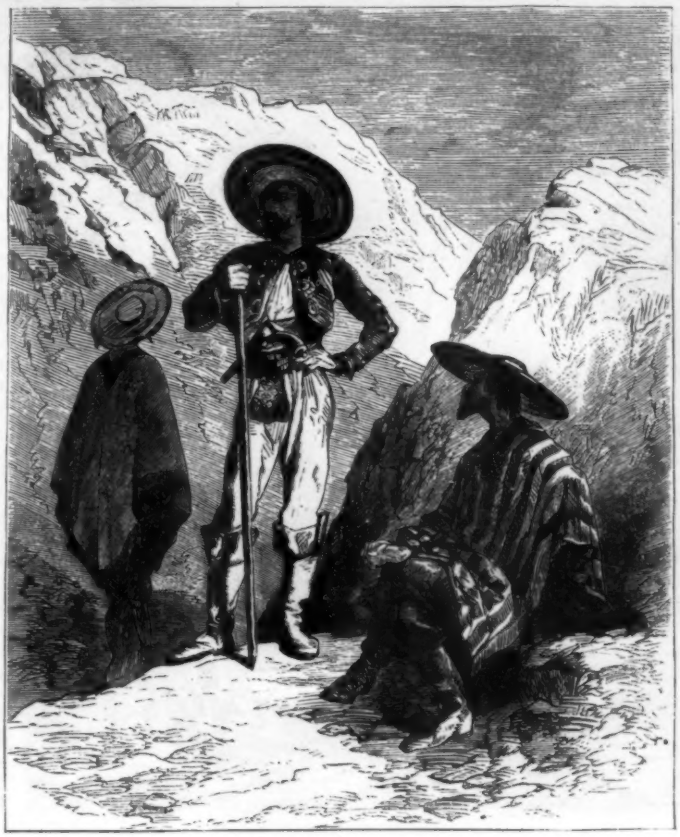
The geometrical progression in the price of diamonds furnishes an explanation of their great value, and also for the precautions which are taken against any chance of losing articles which are not only so precious but also so minute in size. The crown jewels of England are kept in an iron cage, enclosed in glass, in one of the strongest rooms in the Tower of London. The finest and best-cut diamond, unrivalled for shape and water, though not the largest in size, is the "Regent," found in the province of Golconda, named after the Duke of Orleans, who was regent during the minority of Louis XV. It was originally purchased by Pitt, an English Governor of India, for $70,000, and during the five years he had it in his possession, he lived in such constant dread of having it stolen, that he never made known beforehand the day of his coming to town, or slept two nights following in the same house. The Regent of France purchased it of Pitt, giving him nearly three-fourths of a million of dollars for it. It is cut as a *brilliant*.

The next in value is the "Sancy," which fell from the helmet of Charles the Bold, at the battle of Granson, and was sold for two francs by a Swiss soldier, and was subsequently bought by Sancy, treasurer of Henry IV. of France, after whom it was named. During the troubles of the French Republic (1792), all the crown jewels of France were stolen, and the Sancy, after being lost sight of for a long time, in the year 1838 was purchased by a Russian prince for $375,000. In the year 1865 the diamond was purchased by a rich India merchant of its Russian owner for $100,000. There are a number of other diamonds which have a world-wide and most romantic history, but, in the Koh-i-noor, centres the greatest interest.



Miners of St. Ives in Cornwall.

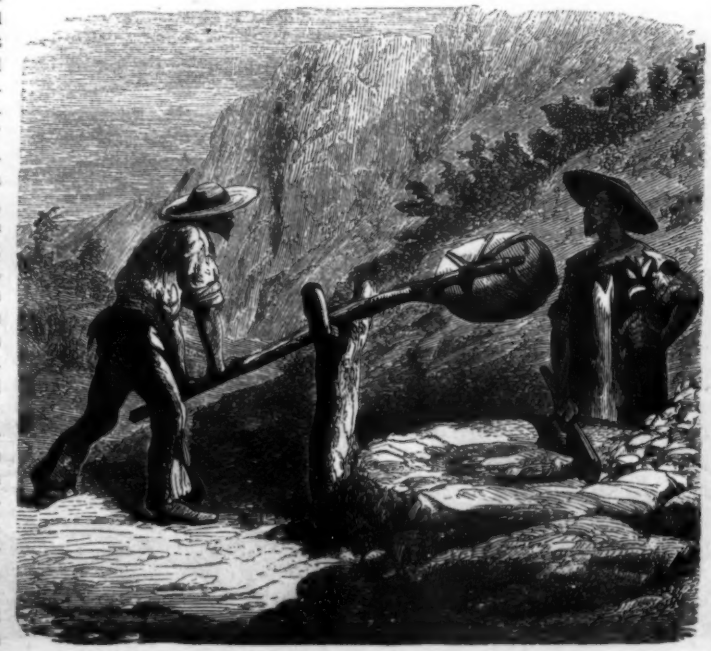
This diamond is said to be the oldest known, for it is claimed that it was worn, and lost in battle, by the Indian Rajah Karhah, 3001 years B. C. In our own times, the "mountain of light" was taken from the King of Cabool, by Runjeet Singh, the "Lion of Lahore," and now belongs to her Majesty the Queen of England. The story of this diamond is a strange one: According to Hindoo legend, it was found in the mines of South India, and remained in the possession of various princes of that country until the Hindoo dynasty was conquered by the Mohammedans, who took the diamond with other spoils. It was first accurately described in 1665, at that time forming part of the royal treasures of Delhi. In the various struggles for power among the native princes, it at last came into the treasury of Lahore. On the annexation of the Punjaub to British India, the authorities took possession of the Lahore treasury, as part payment of the expenses of the war, and it was stipulated that the Koh-i-noor should be presented to Victoria, who now wears it on all state occasions.



Miners of Spanish America in Full Dress.

The sapphire and ruby, one of an azure blue, and the other of a fiery red, are two of the most beautiful of colored gems. They hold next rank to the diamond, and are almost as highly esteemed by some lapidaries, when they are of good water; indeed, perfect rubies, of three and a half grains, and upward, are more valuable than diamonds of equal weight, and fetch higher prices. One form of the ruby is emery, a powder which is applied to the same uses as diamond dust in polishing glass, metals, and other hard substances. The sapphire and emerald sell for $15 per three and a half grains, when fine. The largest sapphire, called the Ruspoli, is in Paris, it is lozenge-shaped, with six faces, and is valued at $24,000.

The emerald, admired for its beautiful green color, is much esteemed.



Crushing Ores by the old Mexican Process.

The largest one in the world is in possession of the Duke of Devonshire. Then comes the topaz, with its characteristic wine yellow color; the garnet, deep red; the turquoise, deep blue; the rich crystal, the amethyst, which, in consequence of its color, violet, is called the Episcopal Stone, bishops being restricted to its use. The opal is a pure white, and, when large and exhibiting its iridescence in perfection, is a beautiful and valuable gem.

The list of fine stones or true gems ends with the amethyst; but green jade may nevertheless be mentioned, which is cut and polished by the Chinese, with such labor and patience, by means of diamond-dust. There is the dark-green jasper, interspersed with bright red specks, commonly called blood-stone, and made into ring-stones, brooches, bracelets, and other ornaments; red jasper, or cornelian, out of which the Egyptians carved many of their scarabæi, and in which they, as well as the Assyrians, and the ancient Etruscans, Greeks, and Romans have cut the most magnificent intaglios. Our forefathers contented themselves with mounting their watch-keys and seals with oval-cut pieces of cornelian, and the Germans of the present day make it into cheap ornaments, with which all their fairs and bazaars are inundated.

There are stones of value which are termed "irregulars," from their relation both to the mineral and organic kingdoms of Nature. There are still some fine and costly stones, but which are not hard and transparent enough to be called true gems; nearly all the substances belonging to this class being rather ornamental stones, suitable for inlaying, mosaic, and for personal wear, than true precious stones.

Beginning with the inorganic kingdoms, we find, amongst others, malachite, with its tints of emerald green, every shade of which is displayed in the same specimen passing

into each other by almost insensible gradations. Then comes the marcasite, which was formerly very popular for brooches and other ornaments. Mirrors made of this substance, cut in thin plates, have been found among the tombs of the Peruvians, and, singular enough, a similar looking-glass, of Roman origin, was found in a peat-deposit on the site of the old wall of the city of London.

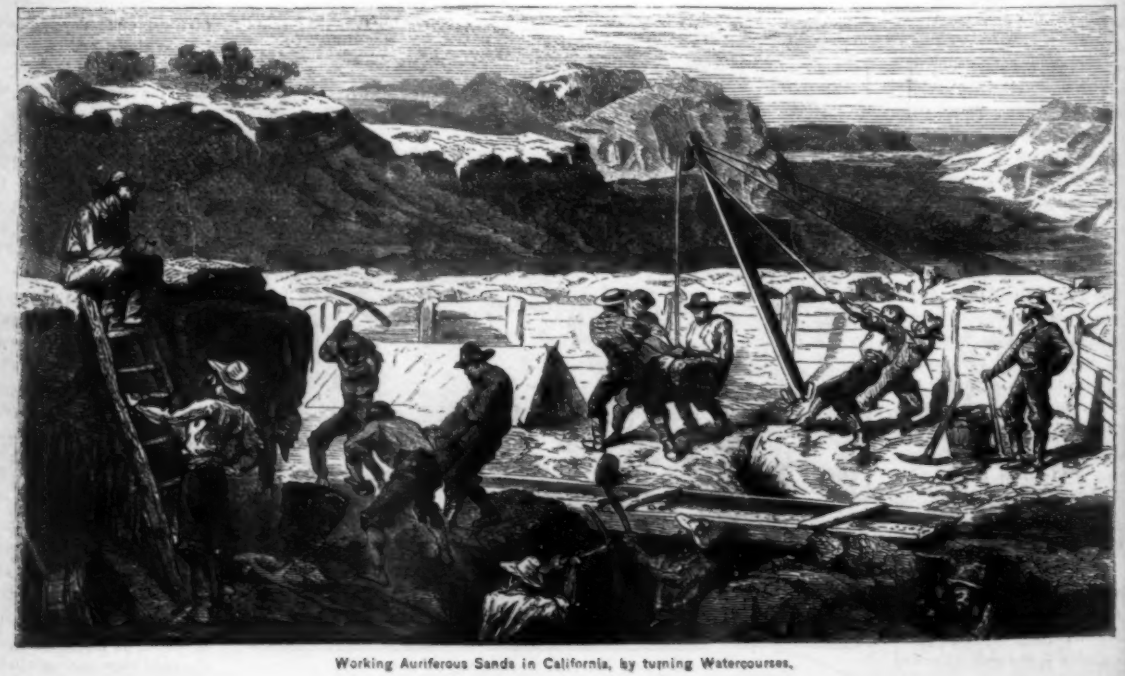
Yellow amber is of vegetable origin. The Turks make it into beautiful necklaces, bracelets, and very elegant mouthpieces for their pipes, chibouques; and devout Mohammedans and Greeks convert their amber necklaces into chaplets. Amber ornaments have come into fashion at the present day, for bracelets and heads of canes.

Formerly, this substance was only procured by picking it up on the sea-shore, but large deposits have since been discovered from sixteen to thirty feet below the surface of the sea. Where it exists, it is fished for in the surf with nets, and dug up out of the sands; but the most successful method is to dredge for it at the bottom of the water.

Chilian Miners.

Ambergris, which is found on the sea-coast, or floating on the surface of certain parts of the Indian Ocean, usually in small pieces, but sometimes in masses of fifty or one hundred pounds' weight, has an agreeable odor, and is used for perfumery. It is a solid, opaque gray-colored substance, very light, and is literally worth its weight in gold, for the Arabs of Zanzibar, when they purchase it, give its weight in gold pieces. Quite recently a New Bedford ship captured a whale, from the head of which were taken over two hundred pounds of mercantile ambergris.

We finally come to gems which are of animal origin, the most important of which is the pearl, produced by some disease in the oyster. Sometimes they are of bluish-gray color, and of a pear shape. When two can be met with of this kind, that are exactly alike, they are almost priceless. The pearl is simply carbonate of lime, and is soluble in the weakest acids. Coral is the product of minute animals, the polyps, which build up whole islands beneath the waters of the sea. The rose-colored variety is held in the greatest estimation.



Working Auriferous Sands in California, by turning Watercourses.